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Implementation of Oral Health Recommendations in Pediatric Primary Care

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Implementation of Oral Health Recommendations in Pediatric Primary Care

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by

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Abstract

Problem: Early childhood caries (ECC) is the most common chronic disease of childhood and fluoride is key to prevention. A major barrier to dental care for children is lack of access to a dental provider. Current practice recommendations include the application of fluoride varnish (FV) in the primary care setting. The purpose of this quality improvement initiative was to evaluate the number of FV applications in a Midwestern, suburban pediatric primary care practice.

Methods: An observational, descriptive design utilizing retrospective medical record reviews for children aged 12-, 18-, 24-, and 36-months who experienced well-child visits between April 1st, 2019 through May 15th, 2019.

Results: A total of 103 patients (N=103) experienced well-child visits in the six-week period. Of the examinations, 56 (54%) were evaluated by the MD and 47 (46%) were evaluated by the NP. Most children (n=76; 74%) did not receive FV, but there were 27 (26%) patients who did. Of those who received a FV application, two were provided by the MD (n=2; 7%) and 25 (n=25; 93%) were provided by the NP. The NP provided significantly more applications despite the MD evaluating more patients ($p < .001$). The average FV cost was $2.00 and reimbursement was $15.30.

Implications For Practice: FV applications of 26% in the primary care office when combined with those reporting visits to a dentist resulted in about 75% of children having preventive treatment by the age of 36-months. In addition, FV applications may provide an additional source of revenue while providing quality healthcare.

Implementation Of Oral Health Recommendations In Pediatric Primary Care

Dental caries is the most common chronic disease of childhood. Although preventable, caries is five times more prevalent than asthma (Dickson & Fontana, 2018; Clark, Kent, & Jackson, 2016). Early childhood caries (ECC) is defined as any sign of caries on a primary tooth in a child younger than six-years of age (American Academy of Pediatric Dentistry [AAPD], 2018). Between 1988 and 2004, the prevalence of ECC increased from 24% to 28% (Dye, Thornton-Evans, Li, & Iafolla, 2015). Today, the prevalence of ECC affects nearly one in four children under the age of five-years, but has varied among race/ethnic and other socioeconomic groups (Clark et al., 2016).

Considered an infectious disease, ECC begins with the accumulation of bacteria, usually *Streptococcus mutans* and other microorganisms mixing with saliva, forming a biofilm on tooth surfaces known as plaque. The bacteria residing in the plaque metabolize dietary carbohydrates, such as sucrose, glucose, fructose, and starch, into an acid capable of demineralizing the tooth enamel. Demineralization is difficult to eradicate once bacterial colonization with *S. mutans* occurs. Constant exposure of the teeth to food and beverages, including water, decreases the pH of the saliva and increases the risk of demineralization (Clark et al., 2016).

Demineralization may be reversed with enamel remineralization when frequent applications of fluoride, a naturally occurring mineral, are provided. If fluoride exposure is inadequate, demineralization will occur at a higher rate than remineralization. One of the first signs of demineralization is the appearance of white spots on the surface of the tooth, most often along the gum line of the maxillary primary incisors and first molars. At this point, ECC is reversible if causative factors are identified and minimized; however, cavitation will likely result if the process is not reversed (Clark et al., 2016). By the time a child is seen in the dental care setting for dental caries, the opportunity for preventing and reversing ECC may have been missed.

In children, pain from dental caries can impair their speech, growth, school attendance and performance, overall health and quality of life. In addition, poor oral health can have a deleterious effect on dentition and soft tissues, causing abscess or cellulitis, and in rare cases, sepsis and death (Clark et al., 2016). Caries lesions also affect the family and society as ECC leads to financial burdens, inconvenience, and missed work for parents. The cost of treating ECC is approximately 10 times higher than the cost of prevention (Clark et al., 2016). For uninsured children, society usually absorbs these costs.

A major barrier to dental care for children is lack of access to a dental provider. The AAPD (2018) has recommended all parents to establish a dental home for their child within six-months of the first tooth eruption or by 12-months of age. However, because of a lack of pediatric dentists or dental providers participating in public insurance programs and with general dentists reluctant to treat very young children, many children do not visit a dentist until much later (Clark et al., 2016; Braun et al., 2017; Gnaedinger, 2018). According to the American Academy of Pediatrics (AAP), 89% of infants and one-year olds have office-based visits with primary care providers annually, compared with only 1.5% who have dental visits (Clark, Slayton, & Section, 2014). For children up to three-years of age, the likelihood of visiting a primary care medical provider is 45 times more likely than visiting a dentist (Clark et al., 2016). Based on these and similar findings, the US Preventive Services Task Force (USPSTF) and the AAP have recommended primary care providers to incorporate oral health risk assessment and preventive therapy into routine well-child visits (Moyer, 2014; Clark, Slayton, & Section on Oral Health, 2014). Consequently, the primary care provider may serve as a resource to decrease the gap in preventive dental care services for children younger than five-years of age.

The purpose of this quality improvement initiative was to evaluate the number of fluoride varnish (FV) applications for one- to three-year olds in a pediatric primary healthcare practice as recommended by the USPSTF and AAP. The aim was to achieve FV applications in at least 25% of toddler well-child visits. The outcome measures of interest were the number of well-child visits, the number of FV applications, the type of provider applying the FV, and the amount of reimbursement for the service. The question of study for implementing FV application recommendations into practice was: During a well-child visit from April 1st through May 15th, 2019 in a Midwestern, suburban pediatric primary care practice for children three-years of age and younger:

1. what was the total number of well-child visits?
2. what was the rate of completed FV applications compared to no FV application during the visit?
3. was there a difference between providers in the number of FV applications given?
4. what was the average reimbursement for providing FV applications?

<u>Review of the Literature</u>

The CINAHL, PubMed, and Cochrane Library databases were searched using the key search terms: *fluoride* OR *fluoride varnish*, *dental caries*, and *children* OR *pediatrics*. Inclusion criteria for selection were publications including children aged five-years and younger in the United States and published within the last five years. Exclusion criteria for selection were children older than five-years, fluoride application in dental practices or schools, preventative strategies such as sealants, and clinical trials. Initially, 265 publications were available but only 15 were selected for this review.

Historically, dental caries in children was thought to be a result of bottle feeding. In 1978, the AAPD, formerly the American Academy of Pedodontics, and the AAP released a joint statement regarding dental caries from bottle feeding. Considering tooth decay to be solely associated with bottle feedings after the first birthday and ad libitum breastfeeding, initial policy recommendations were limited to poor feeding practices. Over the next several decades, however, recognizing the multifactorial etiology of dental caries, including vertical and horizontal transmission of *S. mutans,* high consumption of sugars, and immature enamel and enamel hypoplasia, these organizations revised the term nursing bottle caries, replacing it with ECC. Hence, ECC is defined as one or more decayed, missing, or filled tooth surfaces in any primary tooth in a child under the age of six-years (AAPD, 2018). The complications of ECC include a higher risk of new carious lesions, hospitalizations and emergency room visits, high treatment costs, loss of school days and ability to learn, and diminished health and quality of life.

Barriers to dental health may result from the social determinants of health in the United States. According to data from the National Health and Nutrition Examination Survey completed in 2011-2012, approximately 23% of children aged two- to five-years had dental caries compared with 56% among those aged six-to eight-years (Dye et al., 2015). Untreated tooth decay in primary teeth among children aged two- to eight-years was twice as high for Hispanic and non-Hispanic black children compared with non-Hispanic white children (Dye et al., 2015). In addition to minority children, a higher prevalence of dental caries is found among economically disadvantaged children (Moyer, 2014). The major barrier to dental health care, however, is access to a dental health provider (Clark et al., 2016; Braun et al., 2017; Gnaedinger, 2018).

Fluoride is a key preventive intervention, and fluoride exposure from any combination of sources has cumulative effects on the tooth surface. Three major categories of fluoride exposure include systemic and topical supplementation through fluoridated drinking water, tablets, or drops; topical administration through toothpaste; and professionally-applied fluoride. Community water fluoridation is considered one of the 10 great public health achievements during the 20th century in the United States (Centers for Disease Control and Prevention [CDC], 1999). Water fluoridation began in 1945 in Grand Rapids, Michigan and has affected an estimated 211 million people, or nearly three in four Americans, reducing tooth decay in children and adults by 25% (CDC, 2016). However, water fluoridation varies by geographic location. Adequate water fluoridation contains a minimum 0.6 ppm of fluoride per liter of water; therefore, in areas of low level or absent water fluoride levels, systemic fluoride supplementation is recommended to be prescribed as tablets or drops (CDC, 2016; Moyer, 2014). Recommended dosing is 0.25 mg to 1 mg daily depending on age and fluoridated water concentrations within the community (CDC, 2016). If fluoride supplementation is provided, fluoride sources are recommended to be periodically reviewed for changes to avoid enamel fluorosis, the appearance of fine, white lines on the teeth when exposed to excessive fluoride (CDC. 2016).

The current recommendation for all children living in fluoridated water and fluoride-deficient communities includes the additional daily topical administration through toothpaste. Once the first tooth appears, the AAPD (2018) has recommended brushing with a soft toothbrush and fluoridated toothpaste twice daily. Parents should dispense a rice-sized smear of toothpaste for children less than three-years of age and a pea-sized amount for children aged three- to six-years, and avoid rinsing after brushing (AAPD, 2018). The daily topical administration of fluoride through the use of toothpaste has also contributed to the prevalence decline of dental caries in children.

A third preventive measure includes providing professionally applied FV treatments for children at or younger than five-years of age. The procedure is simple, easily integrated, and can be performed by physicians or other qualified health care professionals. Several studies found FV applications can be completed in under three minutes (Dickson & Fontana, 2018; Sibley, 2018; Gnaedinger, 2018). The recommended FV contains 5% (22,500 ppm) sodium fluoride (AAPD, 2018). The FV provides a highly concentrated dose of fluoride to the surfaces of the teeth, but it is not associated with the occurrence of fluorosis or treatment-related adverse events in children five-years of age and younger (Garcia et al., 2017).

Current practice recommendations to reduce the risk of ECC include FV applications in well-child visits for all children five-years of age or younger and is considered a standard of care for prevention of ECC (AAPD, 2018; Clark et al., 2016). Braun et al. (2017) evaluated FV application by medical providers and found children who received at least four FV applications at a well-child visit by age three-years had a 16% reduction in ECC and a 28% reduction of untreated decay compared with similar children who received fewer FV applications. Similarly, Gnaedinger (2018) found FV was easily added to a well-child visit, was inexpensive, and decreased caries by at least 40%. The establishment of an effective FV treatment program by a medical provider is recommended and can be easily accomplished.

Primary care medical providers need to consider many practice recommendations when health maintenance visits are short. Despite dental practice recommendations, only 4% of primary care practices perform FV applications (Clark et al., 2016). Lack of training, costs of supplies, insurance reimbursement, and questionable profitability are cited as barriers when implementing FV into practice (Clark et al., 2016; Sibley, 2018). Varying reimbursement rates and questions about cost effectiveness for practice can be difficult to assess (Sibley, 2018; Dickson & Fontana, 2018). Strategies are needed to assist primary care medical providers to consider implementing FV into a well-child visit.

The cost for treating dental caries is significantly different than the cost of prevention. The total cost of treating severe dental caries ranges from $10,000 to $25,000 per child (AAPD cited in Clark et al., 2016). The cost of using a preventative 5% sodium fluoride, single-use, 0.4-mL treatment ranges from $0.75 to $2.43 per application (Sibley, 2018). Additional supplies required for the procedure (e.g., gauze, gloves, and a provider's time) are negligible, and the procedure is reimbursable. A FV application is a billable service through five-years of age by Medicaid and commercial payors. In most states, Medicaid will reimburse non-dental health care providers from $9 to $53 per FV, and reimbursement by commercial insurers is $6 to $22 per FV application (Clark et al., 2016; Sibley, 2018). The total reimbursement less the cost of a FV application is calculated to be a potential net revenue of over $15,000 when providing FV to children from age six-months through two-years of age every six months during regularly scheduled well-child appointments (Sibley, 2018). Expanding the age range to the current recommendation of five-years would increase revenue even further, thus incentivizing providers to perform this service. Finally, the low cost and high-level of caries prevention when providing FV for children may minimize societal costs for dental caries treatment in children.

The framework from which this study was proposed is the Plan-Do-Study-Act (PDSA) cycle. A PDSA cycle is a quality improvement method testing a change in the work setting. Steps in the PDSA cycle include: developing a plan to test a change, carrying out the test, analyzing the data, and refining the change based on what was learned from the test (Institute for Healthcare Improvement, n.d.).

Method

Design

An observational, descriptive design was utilized through a retrospective medical record review. The parent organization of the pediatric primary care practice implemented FV applications in April 2019, however, adherence to the recommendations was unknown. This quality improvement (QI) initiative utilized a PDSA cycle to determine baseline information after initial implementation of FV application during a well-child appointment.

Setting

A suburban, Midwestern, organizationally-owned, pediatric primary care practice serving nearly 6,000 children with 70-80% of the children insured by Medicaid. The practice is located in an area with a total population of over one million residents, and more than 58,000 under five-years of age (Missouri Census Data Center, 2019). Pediatric primary care services are provided to those aged 0- through 19-years. The practice employs one pediatrician, one pediatric nurse practitioner, two medical assistants, a medical receptionist, and a practice manager. Office hours are Monday through Friday from 8:00 am to 5:00 pm.

Sample

A convenience sample of a cohort of children aged one- through three-years who experienced a well-child visit between April 1st, 2019 through May 15th, 2019. Inclusion criteria were one-year through three-years of age and a well-child exam visit. Exclusion criteria were under one-year or over three-years of age or an episodic visit for illness or injury.

Approval Process

Approvals from the primary care practice, the doctor of nursing practice (DNP) committee, organizational institutional review board (IRB), and the university IRB were obtained. There was minimal to no risk for subjects as this was a retrospective medical record review. The primary risk was breach of confidentiality. The de-identification of collected data was used to maintain the privacy and confidentiality. The benefits of FV application in early childhood includes prevention of ECC.

Data Collection and Analysis

Data reviewed for this QI initiative included medical records from April 1, 2019 to May 15, 2019. Data collected included demographic information: age, gender, race/ethnicity, and payor. In addition, the number of children experiencing a well-child exam with and without a FV application and the type of provider applying the FV were recorded. Finally, the average reimbursement of the FV service during the study timeframe was calculated.

All data had personal identifiers removed and coded as 19-1, 19-2, 19-3, etc. for a recorded well visit in 2019. The excel spreadsheet containing the project data set was stored on a password-protected computer. No paper records were kept for this project. Only project team members had access to project data. Project data has been retained according to the organization's policies and procedures. Data analysis included descriptive statistics, t-tests or chi-square for comparison with the use of Intellectus Statistics.

Procedures

A team of key stakeholders was formed to include the primary care medical doctor (MD), nurse practitioner (NP), medical assistants (MA), and office manager for the practice. All team members agreed to the process of FV application as: Provide an application pack to include FV and brush. The FV application included treatment directly on the tooth surface. The varnish was to be applied to the teeth of infants and young children aged 12-, 18-, 24-, and 36-months during routine well-child visits. The patient and caregiver were to be provided with verbal after-care instructions specific to the individual product (e.g., avoid eating sticky foods and drinking hot beverages for one hour after application). This process was implemented at the pediatric primary care practice on April 1, 2019.

Results

A total of 103 children aged 12-, 18-, 24-, and 36-months with a well-child visit between April 1st, 2019 and May 15th, 2019 (*N*=103). There were twenty-six 12-month olds (*n*=26; 25.2%); twenty-four 18-month olds (*n*=24; 23.3%); twenty-nine 24-month olds (*n*=29; 28.2%); and twenty-four 36-month olds (*n*=24; 23.3%). The mean age of the patients was 22.37 months (*SD* = 8.74). Gender included female (*n*=47; 46%) and male (*n*=56; 54%). Regarding race/ethnicity, included were Caucasian (*n*=33; 32%), Black or African American (*n*=29; 28%), Hispanic (*n*=11; 11%), Asian (*n*=3; 3%), Multi-Racial (n=4; 4%), and Other (n=23, 22%). Payor status included Medicaid (*n*=77; 74.76%), Private Insurance (*n*=17; 16.5%), Uninsured (*n*=7; 6.8%), Tricare (*n*=1; 0.97%), and Medi Share (*n*=1; 0.97%) (Appendix A).

Of the well-child examinations, 56 (54%) were evaluated by the MD and 47 (46%) were evaluated by the NP. Most children (*n*=76; 74%) did not receive FV, but there were 27 (26%) patients who did. Of those who received a FV application, two were provided by the MD (*n*=2; 7%) and 25 (*n*=25; 93%) were provided by the NP (Appendix B). A Chi-square test of independence found the relationship between provider type and number of FV applications given was statistically significant at the .05 level (χ^2= 32.53, df=1, $p < .001$). The NP was more likely to provide FV treatments than the MD.

Of the patients who received FV (*n*=27), Medicaid insured 89% (*n*=24), there was a private insurer for 4% (*n*=1), and 7% (*n*=2) were uninsured (Appendix C). Medicaid reimbursed $17.00 per application ($408.00) and private insurance paid $5.00 per application ($5.00), resulting in $413 of additional revenue over a six-week period. The uninsured patients paid a flat rate for their well-child visit and received FV at no additional cost. A Kruskal-Wallis test found the relationship between payor and reimbursement was significant based on an alpha value of 0.05 (χ^2 = 24.00, df=1, $p <$ .001). Medicaid reimbursements were higher than private insurance.

Discussion

This QI initiative utilized an initial PDSA cycle to determine baseline information after implementation of FV application during toddler well-child appointments over a six-week period. There were just over 100 (*N*=103) well-child visits for children aged 12-, 18-, 24-, and 36-months over a six-week period. Overall, 26% of these patients received FV compared to 74% who did not have FV applied during the visit. If documented, a common reason for all children not receiving a FV was a previously established dental home. In fact, children evaluated for the 36-month well-child visit had nearly 50% of caregivers reporting a dentist had evaluated the child. While the aim of this initial cycle was to achieve a 25% FV application rate, when FV applications in the primary care office combined with those reporting visits to a dentist, about 75% of children had their oral health preventive care addressed by the age of 36-months.

Of the children receiving a FV application, the NP provided significantly more applications despite the MD evaluating more patients during the study period ($p < .001$). The NP completed 53% FV applications of the 47 patients seen by the NP while the MD completed 4% of the 56 patients seen by the MD. Reasons for this difference were beyond the scope of this study.

Medicaid patients received FV applications more often than those privately insured. The average reimbursement for providing FV applications was $15.30 while actual gross revenue was $413 over a six-week period. Average reimbursement of $15.30 included the cost absorbed by the practice when providing FV applications to uninsured patients. Using both the average of $15.30 per treatment and the current rate (26%) of completed FV applications, a potential annual gross revenue of approximately $3,600 could be projected. The cost of each single-use tray was $1.82. Using the average reimbursement of $15.30 per treatment, the potential annual net income of a fluoride treatment would be $3,200. Consequently, the application of FV treatments were not only important for ECC prevention, but may also provide a source of additional revenue for a pediatric primary care practice.

The pediatric primary care provider can decrease the gap in preventive dental care services for children. FV applications in well-child visits are considered a standard of care for prevention of ECC. While this initial PDSA cycle achieved its aim of a 25% FV application rate during well-child visits at 12-, 18-, 24-, and 36-months, implications for future practice include achieving a higher rate of completed FV applications and expanding to the current recommendation of providing FV applications to children from first tooth eruption to five-years of age.

A limitation to this study was its homogeneity in payor status. Medicaid patients were a significant portion of the practice; therefore, they received treatments significantly more often than those privately insured. Additionally, only one privately insured patient received FV, which limits generalizability of reimbursement data collected on private insurance. Comparison of these findings to a pediatric primary care practice with more privately insured patients is needed to accurately investigate the difference in FV treatments received by publicly and privately insured patients.

Finally, this project successfully introduced a change in practice, however, it also corroborated findings that barriers exist when implementing FV into practice. Reasons for the MD providing significantly fewer FV applications despite evaluating more patients during the study period were beyond the scope of this study, but are recommended for future study. The NP provided FV applications at the end of the appointment, however, similar practices within the organization have shared their workflows, which included utilizing trained medical assistants and applying the FV at the beginning of the appointment. Further studies are needed to better understand how to engage healthcare providers in practice transformation.

Conclusion

This QI initiative successfully introduced a FV application program into a pediatric primary care practice, however, more studies aimed to achieve higher rates of completed FV applications are needed. FV is key to preventing the development of ECC and may provide an additional source of revenue in the pediatric primary care setting. Current practice recommendations include the application of FV for children five-years of age or younger upon the first tooth eruption and every three to six months at subsequent well-child visits. The pediatric primary care provider can decrease the gap in preventive dental care services in early childhood by implementing these oral health recommendations into practice.

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Appendix A

Table 1. Demographic Information.

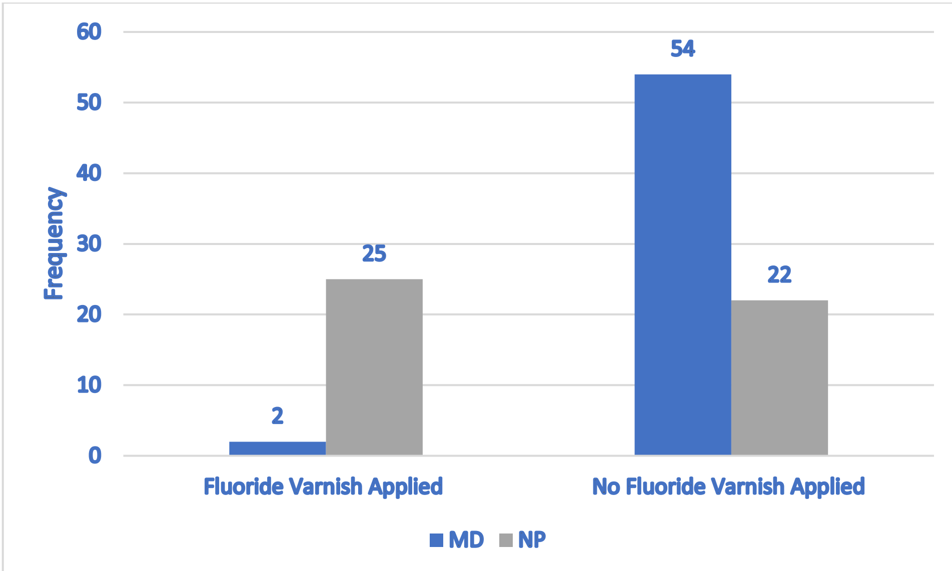
Variable	*n*	%	Cumulative %
Gender			
Female	47	45.63	45.63
Male	56	54.37	100
Missing	0	0	100
Race/Ethnicity			
Asian/Non-Hispanic	3	2.91	2.91
Black or African American/Non-Hispanic	29	28.16	31.07
Multi-Racial/Non-Hispanic	4	3.88	34.95
Caucasian/Non-Hispanic	33	32.04	66.99
Other/Non-Hispanic	23	22.33	89.32
Hispanic	11	10.68	100
Missing	0	0	100
Well Child Exam with Fluoride Varnish			
No fluoride varnish applied	76	73.79	73.79
Fluoride varnish applied	27	26.21	100
Missing	0	0	100
Provider Type			
Physician	56	54.37	54.37
Nurse Practitioner	47	45.63	100
Missing	0	0	100
Payor			
Medicaid	77	74.76	74.76
Private Insurance	17	16.50	91.26
Uninsured	7	6.80	98.06
Tricare	1	0.97	99.03
Medi Share	1	0.97	100
Missing	0	0	100
Notes			
Seen at 13 m.o.	4	3.88	3.88
Unable to do fluoride tx b/c would not be effective- Pt chewing on 2 suckers, stuck in teeth	1	0.97	4.85
Offered, but pt has already been to dentist	1	0.97	5.83
Referred to dentist for caries and general dental care	1	0.97	6.80
Seen at 20 m.o.	1	0.97	7.77

Seen at 19 m.o. ; Went to dentist and got fluoride	1	0.97	8.74
Pt has dental appt	1	0.97	9.71
Seen at 21 m.o.	3	2.91	12.62
Has been to dentist	2	1.94	14.56
Has dental appointment scheduled	1	0.97	15.53
Seen at 14 m.o.	2	1.94	17.48
Seen at 19 m.o.	4	3.88	21.36
Last dental appt was 4 months ago	2	1.94	23.30
Going to the dentist in a couple of weeks	1	0.97	24.27
Saw a dentist	1	0.97	25.24
Dentist appt next month	2	1.94	27.18
Seen at 22 m.o.	1	0.97	28.16
Pt is being seen by dentist	1	0.97	29.13
Pt had done 2wks ago at daycare by dentist	1	0.97	30.10
Going to dentist tomorrow	1	0.97	31.07
Pt has been to dentist already and rec'd fluoride	1	0.97	32.04
Missing	70	67.96	100

Note. Due to rounding errors, percentages may not equal 100%.

Appendix B

Figure 1. Fluoride Varnish Applications By Provider

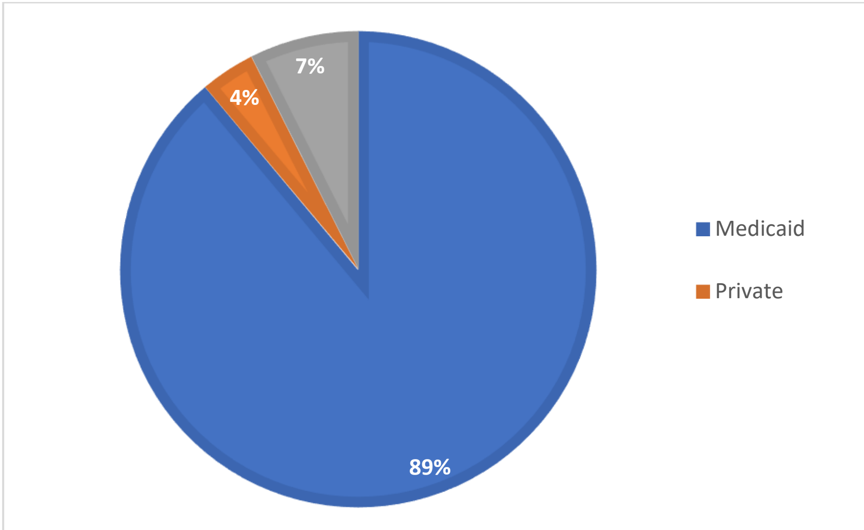


Well Child Exam with Fluoride Varnish	**Provider Type**				
	Physician	**Nurse Practitioner**	χ^2	***df***	***p***
No fluoride varnish applied	54[41.32]	22[34.68]	32.53	1	<.001
Fluoride varnish applied	2[14.68]	25[12.32]			

Note. A Chi-square test of independence found the relationship between provider type and number of FV applications given was statistically significant at the .05 level (χ^2= 32.53, *df*=1, $p < .001$). The NP was more likely to provide FV treatments than the MD.

Appendix C

Figure 2. Reimbursement for FV



Variable	Fluoride varnish applied	No fluoride varnish applied
Payor		
Medi Share	0 (0%)	1 (1%)
Medicaid	24 (89%)	53 (70%)
Private Insurance	1 (4%)	16 (21%)
Tricare	0 (0%)	1 (1%)
Uninsured	2 (7%)	5 (7%)
Missing	0 (0%)	0 (0%)

Note. Medicaid reimbursed $17.00 per application ($408.00) and private insurance paid $5.00 per application ($5.00), resulting in $413 of additional revenue over a six-week period. The uninsured patients paid a flat rate for their well-child visit and received FV at no additional cost. A Kruskal-Wallis test found the relationship between payor and reimbursement was significant based on an alpha value of 0.05 ($\chi^2 = 24.00$, $df=1$, $p < .001$). Medicaid reimbursements were higher than private insurance.